SPH3U UNIVERSITY PHYSICS

WAVES & SOUND

- Introduction (P.372-375)

Tsunami of 2004

On December 26, 2004, movements of Earth off the coast of Sumatra, Indonesia, created a huge disturbance. This disturbance caused a narrow band of ocean floor about 1000 km long to be thrust upward about 15 m in less than 60 s. The enormous pulse of energy set up an extremely large vibration in the Indian Ocean. The vibration crossed thousands of kilometres of open ocean until it reached the shores of Southeast Asia, Sri Lanka, and the eastern coast of Africa and Madagascar. The inhabitants of these countries experienced a monster wave called a "tsunami" – and the results were devastating.

Tsunami of 2004

PRACTICE

1. Many people believe that tsunamis are weather-related and cannot understand how such a destructive wave can occur on an otherwise sunny day, especially so far from the earthquake. How would you explain such phenomena to these people?

Tsunami of 2004

PRACTICE

2. (a) Do you think that people should be allowed to live so close to the ocean in areas that are vulnerable to tsunamis, typhoons, and hurricanes?
   (b) Do you think there should be a government policy about this, or do you think that people should be free to live wherever they please?

Overall Expectations

By the end of this unit, students will:

1. analyse how mechanical waves and sound affect technology, structures, society, and the environment, and assess ways of reducing their negative effects;
2. investigate, in qualitative and quantitative terms, the properties of mechanical waves and sound, and solve related problems;
3. demonstrate an understanding of the properties of mechanical waves and sound and of the principles underlying their production transmission, interaction, and reception.

Big Ideas

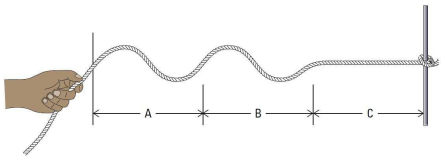
Concepts that students should retain long after this course are:

- Mechanical waves have specific characteristics and predictable properties.
- Sound is a mechanical wave.
- Mechanical waves can affect structures, society, and the environment in positive and negative ways.

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

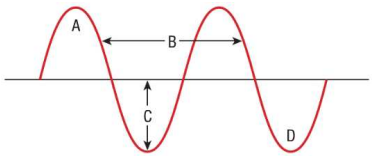
1. The diagram below shows waves being produced on a rope that has one end tied tightly to a post.
   (a) Where does the energy that produces the wave come from?
   (b) In which direction is the wave travelling?
   (c) Did the waves in the two segments take the same amount of time to be produced? How do you know?



Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

2. Identify the indicated parts of the wave shown.



Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

3. Can sound travel in a solid? a liquid? a gas? a vacuum? Give an example of each "yes" answer, and explain any "no" answers that you give.

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

4. Why are you able to see lightning before you hear the sound of the thunder caused by the lightning strike?

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

5. You are standing 85 m from a batter who is hitting a baseball. You see the bat touch the ball, but you do not hear the sound made by the hit until 0.24 s after. What is the speed of sound in air? (Hint: v=d/t)

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

6. (a) Name three sources of loud sounds that you regularly experience in your community.
   (b) Do you think loud sounds are harmful? Why or why not?
   (c) Explain how you think sound travels from its source to your ears.

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

7. Consider the different rooms you have been in and how sound carries in each of them. Describe the rooms in which you could easily hear someone speaking from a distance and others in which you could not hear the person clearly?

Getting Started: Useful Concepts & Skills

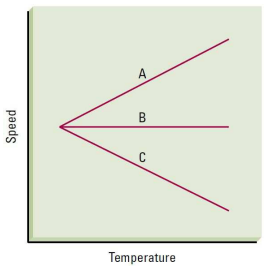
CONCEPTS REVIEW

8. Some of the terms you will encounter in this unit are: infrasonic sounds, ultrasonic sounds, sound barrier, sonic boom, subsonic speed, and supersonic speed. What do you think each of these terms mean?

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

9. Which line on the graph best represents what happens to the speed of sound in air as the temperature increases? Give a scientific reason for your choice.



Getting Started: Useful Concepts & Skills

SKILLS REVIEW

10. Describe how you would experimentally determine the speed at which sound travels in air outside your school. Include any equations you think would apply.

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

11. The photo shows three stringed instruments: a guitar (top), a violin (middle), and a double bass.
    (a) Which instrument do you think produces (i) the lowest sounds and (ii) the highest sounds? Explain your answer.
    (b) Describe in your own words the differences between noise and music.